DevTrack

The Integrated Solution For Defect and Project Tracking

Introduction

DevTrack is one of the most powerful and flexible defect and project tracking solutions available. This paper describes the unique approach and conceptual model that has made DevTrack a clear leader in today's competitive defect tracking market.

Since DevTrack was first introduced in 1996, TechExcel's prospects and customers have evaluated the product primarily in two ways:

- Compare DevTrack feature-by-feature against other commercially available products.
- Study the DevTrack model for managing the defect/project tracking process and determine if this approach satisfies their needs.

Please refer to www.devtrack.com for more information, request a personal demo from our sales team, or download an evaluation copy of the product for your team to perform a thorough evaluation. This paper discusses how DevTrack was designed and implemented. For those that want to compare DevTrack with other defect and project tracking tools based on the low-level architecture and implementation rather than the specific features, this paper will help you gain insight into the DevTrack approach. This paper should also help you decide if the DevTrack model of defect and project tracking is appropriate for your Issue tracking process and for your software development team.

This paper assumes the reader has significant knowledge and experience related to managing a software development process and has previously used DevTrack or some other defect-tracking package. If you have not used DevTrack, we recommend that you download the most recent version of the product from our Web site, install the evaluation software, and test the program using the pre-populated sample project for one or two hours. Some experience using DevTrack will help you understand and appreciate the topics discussed in this paper.

Powerful and Easy to Use

DevTrack is the premiere defect and project tracking tool for software development teams, helping to ensure that development projects finish on time and on budget. DevTrack comprehensively tracks and manages all defects, change, and feature requests, as well as all other development Issues. DevTrack also provides powerful workflow and process automation features, robust searching and reporting, and comprehensive point-andclick customization. Intuitive and powerful, DevTrack provides a scalable out-of-the-box solution.

Using DevTrack and DevTrack Web is efficient and seamless for your development team. When DevTrack was first conceived, our development team was fully aware that DevTrack users would be interacting with the product on a daily basis. We designed and implemented DevTrack to be easy to use, while preserving a powerful feature-set and high-level performance. Whether you are using the DevTrack client application, or using DevTrack Web from home via a 28K modem, you will enjoy very quick response time.

When you evaluate DevTrack against other Defect tracking products, keep in mind your team will be using the product on a daily, hourly, or possibly even a continual basis. Also, take into account the importance of using a product that is well-designed, powerful, and easy to use.

The true value of an excellent defect and project tracking solution is that it improves the overall effectiveness of your team. DevTrack customers consistently report a 25 to 40 percent improvement in their team's overall efficiency. The larger your development project, the better the results you should expect.

Conceptual Models for Defect Tracking

All defect-tracking tools are based on the principle of tracking a development Issue from submission through resolution. DevTrack distinguishes itself from other defect tracking products with its unique Open Workflow and Lifecycle conceptual model. The DevTrack model combines a dynamic lifecycle approach for representing and tracking each development Issue with an integrated team representation that optimizes the development workflow. TechExcel calls this approach the Open Workflow / Lifecycle, or OWL model.

The sections that follow will define and discuss the OWL model in detail, comparing it to the more traditional approaches.

DevTrack's Open Workflow / Lifecycle (OWL) Model

DevTrack represents each development Issue as a complex definable lifecycle from initial creation to verification, resolution, integration, and closure. The DevTrack model tracks an Issue's dynamic history using process-dependant and process-independent properties, overcoming the limitations of the traditional flat model.

Process-dependant properties are fully time sensitive and change throughout the Issue-resolution process. These changes are tracked with the team member making the change, the time the change was made, and the current values for all other properties at that time.

Process-independent properties are more static, and are used primarily to define the fundamental attributes of an Issue in ways that will not change as the Issue lifecycle progresses. DevTrack provides 34 process-independent properties and over 20 process-dependent properties, all of which are completely definable, and can be enabled or disabled as needed.

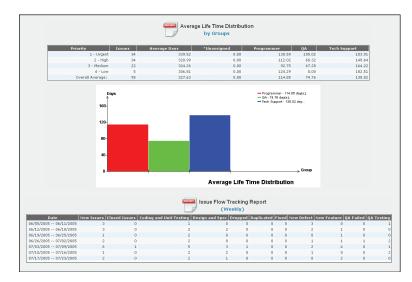
DevTrack represents every development Issue with multiple database tables, some time-dependent and others time-independent. Time-dependant properties are recorded using multiple records and can be unlimited in size, while time-independent properties are recorded using a single record.

DevTrack's Open Workflow/Lifecycle model ensures that every development Issue is effectively tracked using both its static and its dynamic properties, such as the Issue's current owner and progress status. The progress status is defined by an unlimited set of fully definable open states and one closed state. The complete Issue lifecycle then consists of the full set of progress status transitions along with the team member ownership history and user-defined dynamic properties.

With this dynamic model, DevTrack provides the following capabilities.

- All team members can be involved in any phase of an Issue's lifecycle and there is no limit to the number of times the ownership of an Issue can be assigned and reassigned.
- Unique business logic can be applied to all team members such as the submitters, QA members, and programmers, to ensure that each team member has exactly the right level of authority, visibility, and control.
- At any given time an Issue is assigned to one and only one team member, team group, or group folder (refer to next section) to be fully responsible for the current phase of the Issue's lifecycle.
- Teamwork effectiveness can be easily monitored by analyzing

the total lifecycle duration for all Issues. When the average Issue lifetime is minimized, the cumulative work of all the team members involved is optimized.



The DevTrack Team Representation

DevTrack's development team representation is designed to optimize the overall Issue tracking process and team effectiveness. In DevTrack, a team consists of the individual members and team groups, with each member associated with multiple groups when appropriate. The team group concept organizes a development team into smaller specialized entities for work allocation and security. DevTrack also uses the concept of group folders to reflect the fact that an Issue may belong to a group as a whole, instead of an individual team member at a particular phase in its lifecycle. Group folders store common Issues and enable more flexible and definable workflow control.

DevTrack uses an extensive privilege assignment mechanism to maximize team coordination and security. Account Types are created with extensive definable privileges and each team member is then assigned the account type that best represents his/her specialties and responsibilities. Virtually every major function and every field within DevTrack can have its privileges uniquely defined for each account type. This provides the flexibility to customize the workflow and security of a development project based its unique requirements.

DevTrack further associates each account type with a set of read-only fields and a set of invisible fields, providing field-level data security. This

additional security prevents unauthorized viewing or modification of confidential data associated with an Issue.

The effectiveness of each individual or team group can then be evaluated by analyzing each of the phases in which that the person or group is involved.

Benefits of the OWL Model

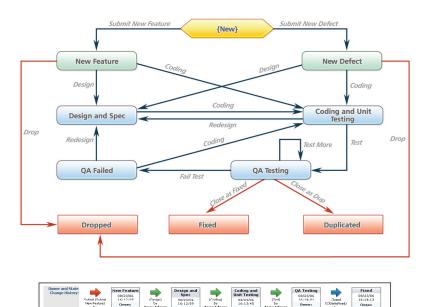
- Combining the dynamic Issue lifecycle model and the development team representation, DevTrack enables an Open Workflow / Lifecycle model, that provides the following benefits:
- An unlimited number of progress states can be defined to track the Issue lifecycle.
- Because there is one primary owner at every phase of an Issue's lifecycle, Issue progress tracking provides accountability and achieves teamwork effectiveness.
- The development team can be represented to include any number of groups and any number of group folders with overlapping team members.
- By defining the appropriate set of account types and assigning each team member the proper account type, development workflow can be enforced through controlled teamwork disciplines.
- By defining proper privileges for each account type, each team member's role within a project is defined and controlled. For example:
 - Programmers may only see development Issues at the phases that require coding and unit testing.
 - Group leaders may forward newly found defects to members of his/her group, but may not assign Issues to members of other groups.
 - Test engineers may submit new defect Issues to a team group or group folder, but may not assign the Issues to individual programmers.
 - Project managers can view and monitor the work progress for his/her entire team, assign Issues among all team groups, and generate reports for one team member, one group, or the entire team.
- DevTrack tracks the entire lifecycle of any development Issue. Further, DevTrack allows each team member to focus solely on the Issues that they currently own and the work needed for that phase. As a result, the activities for each individual team member related to a specific project become much easier to manage.

Defining and Implementing Your Workflow with DevTrack

An Issue workflow is the process by which an Issue's status changes from its initial submission, through intermediate states, to its final resolution. Using DevTrack Admin, you can define a unique workflow for any kind of software project. A good rule of thumb is that a simple workflow that satisfies all of your process

requirements using the fewest possible progress states often achieves the greatest team effectiveness and optimizes the overall development process.

Figure 1 below shows an example of a software development workflow that can be easily configured and enforced with DevTrack.



Design Your Workflow

We recommend the following design and implementation steps to achieve the most effective workflow within DevTrack.

1. Draw your workflow diagram using a format similar to Figure 1 above. Use rectangles to represent progress states, and arrows to

represent the transitions between them.

- 2. Since you may have multiple transitions from a specific state to all next possible states, you should draw multiple arrows connecting each state to all of its next possible states.
- 3. Draw each progress state as node in the workflow graph into your DevTrack project, and define its unique properties. Any state can be designated as an open state, and any state can be defined as a closed state. A closed state is simply one where an Issue is officially closed when moved into this state.
- 4. Define the initial state limitations. For example, an Issue can initially only be in the New Feature or New Defect state.
- 5. Draw all possible transitions for each progress state according to the arrows drawn in the workflow diagram.
- 6. Define the applicable owners for each progress state by individual, group, or account type. For example, only team members with Account Type QA Engineers can be owners for Issues at the state of QA Testing.
- Define who can change an Issue from its current progress status state to next possible states. For example, only QA group leaders and project managers can change Issues from the state of Assigned to QA testing to QA Failed or Closed.
- 8. For each state, define the properties that should be "read only" and those that should be entirely invisible.
- Test your workflow using the DevTrack client application or DevTrack Web, and validate the system logic for the possible workflow scenarios, then make changes as needed.
- 10. Repeat the testing and improvement process until the system behaves exactly as needed for your project.

DevTrack is Completely Configurable

Nearly every aspect of the DevTrack user interface is fully configurable. Some examples of DevTrack's configuration options are outlined below:

- You can fully configure the user interface for both the DevTrack client application and DevTrack Web. The user interface includes the page layout, page content, field positioning, field type, and predefined field choices.
- You can enable multiple Issue property pages including description, current status, version control, time tracking, history, notes, Issueto-Issue links, as well as three completely definable custom pages. Each page can be designated as visible or invisible.
- You can enable or disable the predefined fields. Each field can be customized to record an Issue property specifically defined for your project tracking needs.

- Custom DevTrack fields can be defined to be one of the following controls: single line edit box, multiple line edit control, check box, radio button, dropdown, combo box, auto-grow combo, multiple check box control, multiple radio option control, or time/date control.
- DevTrack supports master/detail field relationships, which can be defined between any two drop-down fields. A detail field can also be the master of an additional field, which enables cascading Master/Detail relationships to be defined within each DevTrack project.

In addition to the project-level customization and configuration, DevTrack offers an extensive set of user-level customization including the look and feel of the user interface and many workflow related preferences.

For example, a user may select to display the DevTrack Issue list with different fields and in different order from other users. A user may also select to customize his/her team member dropdown list to include the team members he/she regularly assigns to new Issues.

DevTrack's extensive customization does not come with a performance penalty. DevTrack's point-and-click customization prevents users from creating extra tables or scripting language. As a result, performance is always optimized by the programming logic, which is not altered by the customization process.

DevTrack's customization is always future version compatible. Because DevTrack does not allow the customization process to create extra tables or scripting language, the database and the program will always be compatible with future versions of the product.

Integrated and Powerful Web and Client/Server Solutions

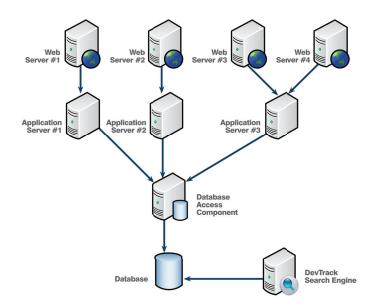
DevTrack Web is an intuitive and powerful complement to the DevTrack client/server application, providing nearly 100 percent of the feature set via the Internet. With DevTrack Web, distributed teams and key customers or beta test sites all benefit from an intuitive LAN-like interface while having access to all of DevTrack's features.

DevTrack Web can be used as a stand-alone product or in tandem with the DevTrack client application uniting internal and external development teams. In fact, you can deploy DevTrack with any combination of the client and Web applications and all data is completely synchronized in real time to the central database. For project managers who need to generate presentation quality reports, the DevTrack client application currently provides advantages over DevTrack Web. The client application also provides advantages for some group operations including the group property change, group forwarding, group duplicating, and group deleting.

One area where the DevTrack client may always offer an advantage over the Web interface is its seamless version control integration. While we will enable version control integration via the Web, these operations will remain a more platform dependent client application, and the client-based integration will offer greater power and flexibility.

DevTrack is fully scalable

DevTrack scales as your team grows. Team groups can share one web server and application server or install their own. Multiple web servers and application servers will handle the workload separately, thus greatly improving the throughput. They will have connect to the Database Access component for any Database operations. A separate search engine can installed to enhance the search performance.



DevTrack Web and Database Replication

When you have multiple development teams in different locations across the country or around the world you can choose to use one DevTrack Web server or multiple DevTrack Web servers. Multiple Web servers can be

installed at the same location as the central DevTrack database server, or at different locations, and can be installed inside or outside of firewalls.

Suppose you have several remote development teams in China and you want to enable these teams to work efficiently with your team in the United States. If you have a dedicated, fast connection between your DevTrack Web server in the U.S. and a Web server in China, you might want to install an additional DevTrack Web server in China. This enables the Chinese development team to use DevTrack Web from their local web server. The Internet performance would be faster assuming the data exchange between the Web server computer in China and the database server in the United States is fast.

In most cases you will find that using a Web server computer local to the database server provides the best performance. Because every page in DevTrack Web is carefully designed to be less than 100K, you will experience responsive performance regardless of your location, even with a 28K modem connection.

While multiple database servers using a carefully designed database replication schema might improve system responsiveness and performance, you run the risk of data update conflicts. Unless you have unidirectional database replication, we do not recommend you use database replication to handle multiple development teams.

Project Related Document Management

DevTrack is designed to manage all aspects of project tracking, including development-related document management. All project related documents, such as internal design, external design, testing cases, and QA documentation, can be managed within the DevTrack database. External HTML links and Web site references can also be managed within DevTrack. You can then link DevTrack Issues with specific design documents, testing cases, etc.

Skills-based Routing and Issue Escalation

Defining and enforcing the defect resolution process is critical for effectively managing software development. DevTrack's definable workflow allows you to create and control process states, transitions, and applicable owners to ensure that every defect and Issue is verified, resolved, tested, integrated, and released as appropriate for your organization. Automatic skills-based routing of new Issues guarantees each team member is always assigned only appropriate Issues to resolve.

Auto-routing ensures that when an Issue is submitted, or re-assigned to a new team member, it is automatically assigned to the most appropriate team member. Routing can be 100% skills-based, 100% workload-based, or a weighted combination of the two.

The auto-routing criteria can be fully customized using any combination of the pre-defined Issue properties such as product, problem area, and priority. Because each combination of Issue properties directly corresponds to the skill set of the team members who would be working on an Issue, it is most appropriate to select the team member based on these criteria. Each criterion is then associated with a list of applicable owners or group folders, each of which is then assigned a ranking index from 1 to 10. An owner with a "10" is the best match for the skills required for the defined criteria.

Auto-escalation is a powerful feature that enables email notification to be setup and repeated as appropriate, and Issues to be automatically re-assigned when needed. Issues can be auto-escalated based on the Planned Finish Date, or based on a Lack of Work Progress.

You can specify the account type, group folder, or a specific owner to which to have the Issue re-assigned. By checking the "Apply auto routing rules" checkbox, the re-assignment will be defined by the rules you have defined in the auto-routing page. You are also able to define a new Progress Status for the Issue when it is re-assigned. This is useful if you need the progress status to change to a state such as "Escalated to group 2" if the Issue is being routed to a more experienced group because it is overdue or no progress has

been made by the existing owner.

The Industry's Best Integration with Microsoft's Visual SourceSafe

DevTrack provides seamless integration with Microsoft's Visual SourceSafe version control software, allowing users to automatically associate an Issue in DevTrack with the check in/check out operations of Visual SourceSafe, providing a tight link between version control and defect management.

With DevTrack's source code control (SCC) add-in module, you can select related DevTrack Issues directly from within Visual SourceSafe or other software development platforms such as Visual Studio and Visual C++, while you perform check-in/check-out operations. This means you can stay

within your IDE without launching DevTrack.

DevTrack/Subversion Integration

DevTrack's built-in integration with Subversion enables connection between DevTrack Issues and Subversion changes. At code check-in time, developers can choose to link the change to specific DevTrack issues. Related changes can also be viewed in DevTrack at the convenience of the users.

DevTrack/Perforce Integration

DevTrack/Perforce integration provides two-way synchronization between DevTrack Issues and Perforce jobs. All the integration rules are definable by using DevTrack Admin with point-and-click operations.

DevTrack/Perforce integration is designed to extend DevTrack's powerful workflow feature to Perforce users. This is achieved by allowing the following synchronization logic:

- Separately defining the sync direction for Perforce jobs to be one directional or bi-directional. You can control the DevTrack Issue owner and Perforce job user to be one way synchronized, two way synchronized, or not synchronized.
- You can further control the synchronization to be progress status dependent. For example, you can define a rule to stop synchronization from Perforce to DevTrack once a development Issue is at QA Testing phase.
- You can also control the synchronization rule to be applied to Issue owner separately from the other Issue properties. For example, you can allow all DevTrack Issue properties to be synchronized with Perforce but not the Issue owner.
- You can apply DevTrack's workflow rules dynamically to each synchronization activity. For example, when a Perforce job in fixed state gets synchronized to DevTrack. The DevTrack Issue can be set automatically to the QA testing progress status state with a predefined QA engineer as the default new owner.

The DevTrack/Perforce integration also provides powerful reporting capabilities to show defect and project tracking and its associations with the source control activities.

Other Version Control systems

TechExcel is committed to continually improving DevTrack and maintaining its leadership in the product development defect and project tracking market. We have version control systems as built-in support for DevTrack including Rational's ClearCase, Merant's PVCS, Microsoft Team Foundation, AccuRev and the popular open-source Concurrent Version System CVS.

Reporting and Analysis

DevTrack provides over 150 pre-defined reports and graphs, including customizable text reports for Issue lists, graphic reports for defect distribution and trends, tabular reports, lifetime analysis reports, Web Query reports, and time tracking reports at the Issue level and project level. Graphical reports include submission and closing trends, resolution time, and development team workload analysis. By combining robust Issue-level searching conditions, with team member and progress status filters, DevTrack dynamically displays focused and relevant reports. Fully customized reports can also be created using Crystal Reports, which can be integrated directly into the DevTrack Report View.

DevTrack's powerful and flexible customization capability for reporting is unsurpassed. You can personalize any of the standard reports; define customer reports without programming; and fully customize layout, Issue properties, grouping, and sorting preferences. Such user-defined custom reports can be designed using Crystal Reports and Web HTML based reports. You can also export any of the DevTrack Web reports to Microsoft Excel users as Web Query reports.

Time and Cost Tracking

Time usage and associated costs for different time categories and rates on any Issue can be added. The General Settings page allows the following properties be defined:

- Enable Issue level time tracking.
- Show Issue level cost information. If this check box is selected, a DevTrack team member can edit the support cost hourly rate along with the time spent in hours.
- The Work Type list window allows a DevTrack project administrator to define work types for time tracking.

The Account Hourly Rate allows the hourly rate to be specified for each account type. The Member Hourly Rate allows the hourly rate to be

specified for each team member. The Account Privilege page defines account types so that some team members can edit time usage for others and can edit the hourly rate for the Issue level time entries.

Email Integration and Notification

DevTrack's Email Submission feature allows external email messages to be sent directly into a DevTrack project, automatically creating an Issue record. The Email Submission page is the area to set up all email information to integrate with the email server. There are four areas that need to be setup to enable email: the General Settings, the Incoming Mail Server, the Outgoing Mail Server, and the Email Auto-Submit page.

The Notification privileges are assigned to Account Types, not individuals. Therefore, if an email privilege is assigned to the Tech Support account type, for example, all members of that account type will be able to receive emails.

Email notification can be triggered by the occurrence of six Events: Issue submission (creation), forward, new note, close, reopen, and status change as shown below:

Email for Issue Owners/Non-Owners

By default, email notifications are sent to Issue owners for all account types. You may uncheck any of these options that are not applicable for your particular project. However, on some occasions it is important that certain users receive email notification even if he/she is not the owner. To allow non-owners to receive email notification when a particular Event takes place, simply highlight the Account Type, go to the Others tab, and check the desired Events. For example, Managers (who may or may not be the owner of an Issue) may wish to be notified when an Issue is submitted, forwarded, or closed.

Notification Conditions

Defining email conditions enables users to receive emails only when the specified condition is met, reducing excessive and unnecessary emails. For example, managers may wish to be notified when Issues are submitted even if he/she is not the Issue owner. However, he/she is only interested in being notified when urgent Issues are submitted. This is easily configured within the DevTrack Admin application.

Email Notification Format

When an Issue notification is emailed, you can define the email format. You have the option of entering information to the subject line, body header, body, and even a signature to the email. This notification can be setup in the Admin under Advanced Features Settings for Email Notification.

Deploying DevTrack

Deploying DevTrack is a relatively easy process. First install the DevTrack database server and the DevTrack Web servers. If you want to use the DevTrack client application, you can install it directly from your DevTrack database server computer, which contains a DevTrack client setup folder for automated installation.

DevTrack can be configured to use one or multiple server computers. The DevTrack Web server can share the same computer with the DevTrack Application/Database server or the Web and Application/Database servers can be installed on separate systems.

Advantages of Using Multiple Servers

- Your system is more scalable.
- If you have a good LAN connection between the Application/ Database server and the Web server computers, you will have better performance when you have a high number of concurrent users.
- You can configure your Web server to be outside of your corporate firewall and your Application/Database server inside your firewall to have more security control.

Advantages of Using One Server Computer

- It may be more cost effective.
- If you have a high number of concurrent users in the hundreds or thousands range, DevTrack client/server applications and Web servers will still offer good performance.
- If you do not need to gain the additional security control as outlined above, one server computer will offer good performance.

Integration with ServiceWise

ServiceWise is a completely integrated Customer Support and Help Desk solution, combining the power of the Web with sophisticated client/server applications. ServiceWise also integrates workflow, communication, and database management technologies. The result is a tremendously powerful and flexible tool that provides a 100% complete Web solution and a complete client/server solution, with seamless integration. ServiceWise provides the ultimate solution for today's demanding Customer Support

organizations.

DevTrack and ServiceWise can be configured to share a common database, allowing development teams and customer support teams to easily collaborate and share data. When a customer support incident is an indication of a possible software defect, the support team can easily copy the incident from ServiceWise into DevTrack as a new defect, to be managed and resolved by the development team.

DevTrack Enterprise Edition

The DevTrack 6.1 Standard Edition includes all the features of DevTrack version 6.03 plus some feature enhancements. DevTrack 6.1 Enterprise Edition includes all the Standard Edition features plus new advanced features.

Software Development Lifecycle Management (SDLC) is becoming increasingly important to today's software development teams. DevTrack is designed as a total product development project-tracking solution – starting with Day One. Hundreds of companies are deploy DevTrack to manage their software development project tracking and total lifecycle management.

DevTrack Enterprise Edition is designed and developed to provide customers with additional advanced features to achieve better product lifecycle tracking and management tools. DevTrack 6.1 Enterprise Edition offers the following advanced features:

Release Management

The Release Management module adds exciting capabilities to the Enterprise Edition of DevTrack 6.1. Using this system, a parent issue can spawn several child test issues, each belonging single issue to a distinct product, versions, and build. An unlimited number of these child issues can be used to track the resolution of the parent issues across these diverse environments.

QA Test Events

A new type of event, called QA Test Events, allows for unprecedented coverage of issue verification. QA test events can be linked to Build subprojects, allowing issues within those subprojects to automatically generate testing across different platform, languages, or any other user defined variable. The results of these tests can be used to automate the parent issue.

Co-owner Events

A co-owner event allows DevTrack users to define multiple owners of different areas of an issue. For instance, if an issue needed a fix in several different versions of a component, a co-owner event could be created. This event would assign ownership to a unique set of users based on a variable or field value.

Event Workflow Improvements

The event workflow in DevTrack 6.1 has been completely revamped. The new functionality adds ease of configuration, and more options for defining transition-based event triggers. The event workflow allows you to automatically create certain sub-issues when an issue changes state or a certain action is performed on an issue. Conditions can be applied to the creation of these items. The event workflow can also prevent a transition from occurring if certain tasks are not completed.

Event Automation Improvements

In addition to the status of an event automating the status of an issue, DevTrack 6.1 now allows the status of a group of events to affect this automation. For instance, it is now possible to say that when all events of a certain group, such as Approval, are closed successfully, progress to the next state. However, if any of these events are closed but not successful, another state automation can occur.

 Subprojects as Conditions of Email Notifications

Subprojects can now be used a condition within email notifications.

DevPlan Integration

DevTrack 6.1 Enterprise Edition is fully integrated with DevPlan, TechExcel's new project management tool. Managers can create and manage project plans in DevPlan, and use DevTrack to track the implementation of those projects.

For a more detailed discussion on DevTrack Enterprise Edition, please refer to the DevTrack Enterprise Edition white paper.